42- 079- 00014

COMMONWEALTH OF PENNSYLVANIA
Department of Environmental Protection
Bureau of Air Quality
December 11, 2012
717-787-9483

SUBJECT: Source Test Review
UGI Development Company
Hunlock Creek Energy Center
Combined Cycle Combustion Turbine Unit No. 5, Source ID CT5
Hunlock Township, Luzerne County
Plan Approval No. 40-328-006
eFacts ID No. 2042582
PFID No. 284013

TO: Brian Halchak, w/o attachments
Air Quality Program
Northeast Regional Office

FROM: Darren Lauer DTL
Air Quality Specialist
Source Testing Section
Division of Source Testing and Monitoring

THROUGH: Charles Zadakis CZ
Chief
Division of Source Testing and Monitoring

Rick Begley RKB
Chief
Source Testing Section
Division of Source Testing and Monitoring

UGI Development Company operates two GE LM 600 PC-Sprint combustion turbine generators (CTG's) identified as CTG Units 5 & 6 (ID's CT5 & CT6, respectively) and two associated natural gas fired heat recovery steam generators (HRSG's) identified as Units 5 & 6 HRSG's (ID's DB5 & DB6, respectively) at its Hunlock Creek Energy Center Facility. Each turbine has a rated heat input capacity of 471.2 MMBtu/hr and a nominal rated electrical power generation capacity of 122 Megawatts (MW). The combustion turbine generator units are used for electrical power generation. Exhaust gases from each turbine are routed to its associated HRSG that is equipped with a duct burner having a rated heat input capacity of 38.9 MMBtu/hr. The HRSG's operate with and without the duct burner on to produce supplemental steam used for additional electrical power generation. The CT's fire natural gas as a primary fuel and are capable of firing low sulfur distillate fuel oil and the HRSG duct burners fire natural gas. CO emissions from each turbine are controlled by an oxidation catalyst and NOX emissions are controlled using water injection and a selective catalytic reduction (SCR) unit. The effluent from each unit is discharged to the atmosphere through individual exhaust stacks for each CT.

On December 7 & 8, 2011, CEMServices, Inc. performed compliance testing for combustion turbine no. 5 in accordance with the plan approval. Testing was conducted to determine total particulate matter < 10 microns in aerodynamic diameter (filterable PM < 10 microns in aerodynamic diameter (FPM_{10}) and condensable PM (CPM)), ammonia (NH_3), sulfuric acid (H_2SO_4), sulfur dioxide (SO_2), volatile organic compounds (VOC), nitrogen oxides (NOx), and carbon monoxide (CO) emissions from the turbine exhaust. During testing, EPA Methods 1, 2, 3A, 4, 7E, 10, 18/ 25A, 201A, 202, and EPA conditional test methods 13 (CTM13) and 27 (CTM27) were used. Only natural gas was fired during testing for CT no. 5 and for its associated duct burners. Three test runs were performed during testing for CT no. 5 while the HRSG duct burners were on and three test runs were performed while the burners were off, overall, six test runs were performed for each pollutant measured. Note that the test contractor performed an additional two THC monitoring test runs which did not include any measured methane results for subtraction to determine VOC results and these are not shown in the tables below.

UGI representative, Jeff Steeber, indicated that the fuel flow pressure regulator for the duct burners was not operating properly during the test. This caused significant variation in the fuel supply to the burners with instances of incomplete combustion. A retest of CT5 firing natural gas with the duct burners firing was performed on 8/11/12 because the operation of the source did not represent normal operating conditions.

In addition, note that the Laboratory detection limit did not provide sufficient resolution to demonstrate compliance with the 0.0009 lbs/MMBtu emission rate. It is recommended that the company repeat the test using sufficient resolution to demonstrate compliance.

Except as noted previously, the CT5 test results are acceptable to the Department as representative of emissions at operating conditions similar to those during testing and may be used for compliance determinations.

The following is a summary of data presented in the test report for the combined-cycle Turbine No. 5 source (ID CT5) with and without HRSG No. 5 duct burners on:

Process Data During Total PM_{10} Test Results for CT5 & Duct Burners Firing Natural Gas:

Test Date: 12/7/11				
Run Number	**1**	**2**	**3**	**Avg.**
Run Times	**09:20 to 13:00**	**13:25 to 16:30**	**17:05 to 20:10**	**-**
Operating Load During Testing (MW) [1]	60.6	61.6	61.7	61.3
Maximum Nominal Rated Operating Load (MW)	65			
% of Maximum Nominal Rated Operating Load [1]	93.2	94.8	94.9	94.3
Fuel Flow Rate (Mscf/hr) [1]	464.3	470.4	470.7	468.5

Total PM_{10} Test Results for CT5 & Duct Burners Firing Natural Gas:

Test Date: 12/7/11				
Run Number	**1**	**2**	**3**	**Avg.**
Run Times	**09:20 to 13:00**	**13:25 to 16:30**	**17:05 to 20:10**	**-**
Volumetric Flow Rate (dscfm)	243,169	247,525	240,966	243,887
$FPM_{2.5/10}$ Emission Concentration (gr/dscf)	0.00100	0.00025	0.00035	0.00053
$FPM_{2.5/10}$ Mass Emission Rate (lbs/hr)	2.05	0.53	0.72	1.10
$FPM_{2.5/10}$ Mass Emission Rate (lbs/MMBtu)	0.0037	0.0009	0.0014	0.0020
$FPM_{2.5/10}$ Allowable Mass Emission Rate (lbs/MMBtu)	0.0141			
CPM Emission Concentration (gr/dscf)	0.00094	0.00082	0.00045	0.00074
CPM Mass Emission Rate (lbs/hr)	1.97	1.74	0.96	1.56
CPM Inorganic Mass Emission Rate (lbs/MMBtu)	0.0036	0.0031	0.0017	0.0028
Total PM_{10} Emission Concentration (gr/dscf)	0.00194	0.00107	0.00080	0.00127
Total PM_{10} Mass Emission Rate (lbs/hr)	4.02	2.27	1.68	2.66
Total PM_{10} Mass Emission Rate (lbs/MMBtu)	0.0073	0.0040	0.0031	0.0048
Total PM_{10} Allowable Mass Emission Rate (lbs/MMBtu)	0.0141			

Process Data During H_2SO_4 & SO_2 Test Results for CT5 & Duct Burners Firing Natural Gas:

Test Date: 12/7/11				
Run Number	**1**	**2**	**3**	**Avg.**
Run Times	**11:05 to 12:05**	**13:25 to 14:25**	**15:15 to 16:15**	**-**
Operating Load During Testing (MW) [1]	61.5	61.6	61.8	61.6
Maximum Nominal Rated Operating Load (MW)	65			
% of Maximum Nominal Rated Operating Load [1]	94.6	94.8	95.1	94.8
Fuel Flow Rate (Mscf/hr) [1]	470.4	469.9	470.9	470.4

H_2SO_4 & SO_2 Test Results for CT5 & Duct Burners Firing Natural Gas:

Test Date: 12/7/11				
Run Number	**1**	**2**	**3**	**Avg.**
Run Times	**11:05 to 12:05**	**13:25 to 14:25**	**15:15 to 16:15**	**-**
Sulfuric Acid Emission Concentration (gr/dscf, as H_2SO_4) [1]	< 0.0003	< 0.0003	< 0.0003	< 0.0003
Sulfuric Acid Mass Emission Rate (lbs/MMBtu, as H_2SO_4) [1]	< 0.0011	< 0.0011	< 0.0011	< 0.0011
Sulfuric Acid Allowable Mass Emission Rate (lbs/MMBtu, as H_2SO_4)	0.0009			
SO_2 Emission Concentration (gr/dscf) [1]	< 0.0006	< 0.0003	< 0.0003	< 0.0004
SO_2 Mass Emission Rate (lbs/MMBtu)	< 0.0023	< 0.0024	< 0.0013	< 0.0020
SO_2 Allowable Mass Emission Rate (lbs/MMBtu)	0.0030			

Process Data During NOx, CO, & VOC Test Results for CT5 & Ducts Burner Firing Natural Gas:

Test Date: 12/7/11				
Run Number	**1**	**2**	**3**	**Avg.**
Run Times	**09:20 to 10:20**	**10:49 to 11:48**	**12:00 to 13:00**	**-**
Operating Load During Testing (MW) [1]	60.6			
Maximum Nominal Rated Operating Load (MW)	65			
% of Maximum Nominal Rated Operating Load [1]	93.2			
Fuel Flow Rate (Mscf/hr) [1]	464.3			

NOx, CO, & VOC Test Results for CT5 & Duct Burners Firing Natural Gas:

Test Date: 12/7/11				
Run Number	**1**	**2**	**3**	**Avg.**
Run Times	**09:20 to 10:20**	**10:49 to 11:48**	**12:00 to 13:00**	**-**
Volumetric Flow Rate (dscfm)	238,799	243,169	243,169	241,712
Oxygen (%)	14.0	14.1	14.1	14.1
NOx Emission Concentration (ppmdv)	2.3	2.3	2.2	2.3
NOx Emission Concentration (ppmdv, at 15 % O_2)	2.0	2.0	1.9	2.0
NOx Allowable Emission Concentration (ppmdv, at 15 % O_2)	2.90			
NOx Mass Emission Rate (lbs/hr)	3.99	4.02	3.87	3.96
CO Emission Concentration (ppmdv)	2.6	2.6	2.4	2.5
CO Emission Concentration (ppmdv, at 15 % O_2)	2.2	2.3	2.1	2.2
CO Allowable Emission Concentration (ppmdv, at 15 % O_2)	4.0			
CO Mass Emission Rate (lbs/hr)	2.69	2.79	2.53	2.67
VOC Emission Concentration (ppmdv, as CH_4)	0	1.9	1.1	1.0
VOC Emission Concentration (ppmdv, as CH_4 at 15 % O_2)	0	1.7	1.0	0.9
VOC Allowable Emission Concentration (ppmdv, as CH_4 at 15 % O_2)	1.2			
VOC Mass Emission Rate (lbs/hr)	0	1.17	0.69	0.62

Process Data During Ammonia Test Results for CT5 & Duct Burners Firing Natural Gas:

Test Date: 12/7/11				
Run Number	**1**	**2**	**3**	**Avg.**
Run Times	**09:20 to 10:20**	**17:00 to 18:05**	**18:30 to 19:35**	**-**
Operating Load During Testing (MW) [1]	60.6	61.6	62.4	61.5
Maximum Nominal Rated Operating Load (MW)	65			
% of Maximum Nominal Rated Operating Load [1]	93.2	94.8	96.0	94.7
Fuel Flow Rate (Mscf/hr) [1]	464.3	469.7	471.8	468.6

Ammonia Test Results for CT5 & Duct Burners Firing Natural Gas:

Test Date: 12/7/11				
Run Number	**1**	**2**	**3**	**Avg.**
Run Times	**09:20 to 10:20**	**17:00 to 18:05**	**18:30 to 19:35**	**-**
Volumetric Flow Rate (dscfm)	238,799	239,508	238,865	239,057
Oxygen (%)	14.0	14.1	14.1	14.1
Ammonia Emission Concentration (ppmdv, as NH_3)	3.6	4.4	4.2	4.1 [1]
Ammonia Emission Concentration (ppmdv at 15 % O_2, as NH_3)	3.1	3.8	3.6	3.5
Ammonia Allowable Emission Concentration (ppmdv at 15 % O_2, as NH_3)	5			
Ammonia Mass Emission Rate (lbs/hr)	2.29	2.81	2.64	2.58

Process Data During Total PM_{10} Test Results for CT5 Firing Natural Gas - Duct Burners Off:

Test Date: 12/8/11				
Run Number	**1**	**2**	**3**	**Avg.**
Run Times	**08:00 to 11:05**	**11:22 to 14:27**	**15:10 to 18:15**	**-**
Operating Load During Testing (MW) [1]	50.7	50.8	50.9	50.8
Maximum Nominal Rated Operating Load (MW)	50			
% of Maximum Nominal Rated Operating Load [1]	101.4	101.6	101.8	101.6
Fuel Flow Rate (Mscf/hr) [1]	460.7	465.6	467.1	464.5

Total PM_{10} Test Results for CT5 Firing Natural Gas - Duct Burners Off:

Test Date: 12/8/11				
Run Number	**1**	**2**	**3**	**Avg.**
Run Times	**08:00 to 11:05**	**11:22 to 14:27**	**15:10 to 18:15**	**-**
Volumetric Flow Rate (dscfm)	242,141	245,393	242,505	243,346
$FPM_{2.5/10}$ Emission Concentration (gr/dscf)	0.00030	0.00051	0.00035	0.00039
$FPM_{2.5/10}$ Mass Emission Rate (lbs/hr)	0.63	1.08	0.73	0.81
$FPM_{2.5/10}$ Mass Emission Rate (lbs/MMBtu)	0.0011	0.0020	0.0014	0.0015
$FPM_{2.5/10}$ Allowable Mass Emission Rate (lbs/MMBtu)	0.0141			
CPM Emission Concentration (gr/dscf)	0.00062	0.00038	0.00067	0.00056
CPM Mass Emission Rate (lbs/hr)	1.28	0.80	1.45	1.18
CPM Inorganic Mass Emission Rate (lbs/MMBtu)	0.0024	0.0015	0.0027	0.0022
Total PM_{10} Emission Concentration (gr/dscf)	0.00092	0.00089	0.00102	0.00094
Total PM_{10} Mass Emission Rate (lbs/hr)	1.91	1.88	2.18	1.99
Total PM_{10} Mass Emission Rate (lbs/MMBtu)	0.0035	0.0035	0.0041	0.0037
Total PM_{10} Allowable Mass Emission Rate (lbs/MMBtu)	0.0141			

Process Data During H_2SO_4 & SO_2 Test Results for CT5 Firing Natural Gas - Duct Burners Off:

Test Date: 12/8/11				
Run Number	**1**	**2**	**3**	**Avg.**
Run Times	**12:20 to 13:20**	**13:54 to 14:54**	**15:40 to 16:40**	**-**
Operating Load During Testing (MW) [1]	50.8	50.9	51.0	50.9
Maximum Nominal Rated Operating Load (MW)	50			
% of Maximum Nominal Rated Operating Load [1]	101.6	101.8	102.0	101.8
Fuel Flow Rate (Mscf/hr) [1]	466.0	466.5	467.1	466.5

H_2SO_4 & SO_2 Test Results for CT5 Firing Natural Gas - Duct Burners Off:

Test Date: 12/8/11				
Run Number	**1**	**2**	**3**	**Avg.**
Run Times	**12:20 to 13:20**	**13:54 to 14:54**	**15:40 to 16:40**	**-**
Sulfuric Acid Emission Concentration (gr/dscf, as H_2SO_4) [1]	< 0.0003	< 0.0004	< 0.0003	< 0.0003
Sulfuric Acid Mass Emission Rate (lbs/MMBtu, as H_2SO_4) [1]	< 0.0013	< 0.0014	< 0.0013	< 0.0013
Sulfuric Acid Allowable Mass Emission Rate (lbs/MMBtu, as H_2SO_4)	0.0009			
SO_2 Emission Concentration (gr/dscf) [1]	< 0.0004	< 0.0004	< 0.0003	< 0.0004
SO_2 Mass Emission Rate (lbs/MMBtu) [1]	< 0.0015	< 0.0014	< 0.0013	< 0.0014
SO_2 Allowable Mass Emission Rate (lbs/MMBtu)	0.0030			

Process Data During NOx, CO, & VOC Test Results for CT5 Firing Natural Gas - Duct Burners Off:

Test Date: 12/8/11				
Run Number	**1**	**2**	**3**	**Avg.**
Run Times	**08:02 to 09:02**	**09:11 to 10:11**	**10:21 to 11:21**	**-**
Operating Load During Testing (MW) [1]	50.5	50.7	50.8	50.7
Maximum Nominal Rated Operating Load (MW)	50			
% of Maximum Nominal Rated Operating Load [1]	101.0	101.4	101.6	101.3
Fuel Flow Rate (Mscf/hr) [1]	458.5	459.8	463.0	460.4

NOx, CO, & VOC Test Results for CT5 Firing Natural Gas - Duct Burners Off:

Test Date: 12/8/11				
Run Number	**1**	**2**	**3**	**Avg.**
Run Times	**08:02 to 09:02**	**09:11 to 10:11**	**10:21 to 11:21**	**-**
Volumetric Flow Rate (dscfm) [1]	242,805	242,966	240,993	242,255
Oxygen (%)	14.4	14.4	14.3	14.4
NOx Emission Concentration (ppmdv)	2.7	2.5	2.3	2.5
NOx Emission Concentration (ppmdv, at 15 % O_2)	2.4	2.3	2.0	2.2
NOx Allowable Emission Concentration (ppmdv, at 15 % O_2)	2.5			
NOx Mass Emission Rate (lbs/hr)	4.71	4.35	3.90	4.32
CO Emission Concentration (ppmdv)	1.6	2.0	2.6	2.1
CO Emission Concentration (ppmdv, at 15 % O_2)	1.5	1.8	2.3	1.9
CO Allowable Emission Concentration (ppmdv, at 15 % O_2)	4.0			
CO Mass Emission Rate (lbs/hr)	1.72	2.16	2.71	2.20
VOC Emission Concentration (ppmdv, as CH_4)	0.0	0.3	0.0	0.1
VOC Emission Concentration (ppmdv, as CH_4 at 15 % O_2)	0.0	0.3	0.0	0.1
VOC Allowable Emission Concentration (ppmdv, as CH_4 at 15 % O_2)	1.2			
VOC Mass Emission Rate (lbs/hr)	0.00	0.17	0.00	0.06

Process Data During Ammonia Test Results for CT5 Firing Natural Gas - Duct Burners Off:

Test Date: 12/8/11				
Run Number	**1**	**2**	**3**	**Avg.**
Run Times	**08:15 to 09:15**	**09:20 to 10:22**	**10:30 to 11:35**	**-**
Operating Load During Testing (MW) [1]	50.5	50.7	50.8	50.7
Maximum Nominal Rated Operating Load (MW)	50			
% of Maximum Nominal Rated Operating Load [1]	101.0	101.4	101.6	101.3
Fuel Flow Rate (Mscf/hr) [1]	458.5	459.8	463.0	460.4

Ammonia Test Results for CT5 Firing Natural Gas - Duct Burners Off:

Test Date: 12/8/11				
Run Number	**1**	**2**	**3**	**Avg.**
Run Times	**08:15 to 09:15**	**09:20 to 10:22**	**10:30 to 11:35**	**-**
Volumetric Flow Rate (dscfm)	242,805	242,966	240,993	242,255 [1]
Oxygen (%)	14.4	14.4	14.3	14.4
Ammonia Emission Concentration (ppmdv, as NH_3)	4.3	4.3	4.2	4.3 [1]
Ammonia Emission Concentration (ppmdv at 15 % O_2, as NH_3)	3.8	3.9	3.8	3.8
Ammonia Allowable Emission Concentration (ppmdv at 15 % O_2, as NH_3)	5			
Ammonia Mass Emission Rate (lbs/hr)	2.73	2.75	2.68	2.72

[1] reviewer calculated or corrected values or averages based upon the reported data

cc: Ray Kempa, Northeast Regional Office, w/o attachments
AIMS/AKB, w/o attachments
EPA/AKB, w/o attachments
Reading File, Source Testing Section, w/o attachments

ec: V. Trivedi, New Source Review Section, Division of Permits, w/o attachments